

**REMARKS**

The Official Action of April 7, 2005, and the prior art cited and relied upon therein have been carefully studied. The claims in the application are now claims 1-12, and these claims define patentable subject matter warranting their allowance. Favorable reconsideration and such allowance are respectfully urged.

Claims 1-12 remain in the application for consideration.

In response to the Examiner's objection to claim 12 and rejection of claims 3 and 6 under 35 U.S.C. §112, second paragraph, Applicant has amended claims 12, 3 and 6 to eliminate each of the problems identified in these claims. Applicant respectfully submits that the objection and rejection under 35 U.S.C. §112 have now been overcome.

The Examiner has further rejected claims 1-12 under 35 U.S.C. §102(b) as being anticipated by JP 2002-126907 and claims 1, 2, 4, 5, 7 and 10-12 under 35 U.S.C. §103(a) as being unpatentable over JP 2002-126907 in view of Watanabe '971. Applicant respectfully traverses these rejections as applied to the claims as amended and for the following reasons.

The Primary Characteristics of the Claimed Invention

- (1) The curves envisaged in Figs. 1 and 7 are not curves defined according to any specific equations, but are curves that may be varied freely in shape.
- (2) The structural feature of the claimed invention are directed to controlling three linear axes (of these three axis, only one axis is a high acceleration axis), and one is a turning axis. In particular there is:
  - a linear axis along which the X-axis table 4 is moved in the X-axis direction,
  - a linear axis along which the Z-axis table 3 is moved in the Z-axis direction,
  - a linear axis (high acceleration axis) along which the slider 12 is moved in the Y-axis direction, and
  - a turning axis of the spindle 14.
- (3) The claimed invention is envisaged as making direct numerical control practical in a NC processor.
- (4) The control commands in the claimed invention are not commands generated by dividing the peripheral velocity into blocks, but commands generated corresponding to the acceleration exerted on the slider.

The commands in the claimed invention are constituted with the incremental amount of moving pulse, i.e. every 0.25ms, 0.5ms or 1ms (2ms, 3ms).

- (5) The prediction learning control system in the claimed invention does not employ the transfer function.

The prediction learning control system in the claimed invention postulates that the data are delivered with periodic repetitions, and therefore the amount to be corrected is determined by means of actually conducting some frequencies of the periodic repetitions. Thus, the first period is considered to be substantially in error. When the data fluctuate is subtle in every periodic repetition, it is expected to determine the amount to be corrected by the predictability, or actual data prefetch, thereby making it easier to carry out the machining in real time without causing time lag.

- (6) The claimed invention is envisaged to make, at any given time, the most of the ability of working speed, which is intrinsic in the processor. With the concept of the claimed invention, the acceleration exerted on the slider is set on the preselected acceleration. The rpm of the spindle

varies in conformity with the preselected acceleration of the slider. The movement of the slider in both the Y-axis and X-axis directions is controlled in synchronized relation with the varied rpm of the spindle, thereby generating the desired curved surface of the workpiece.

#### Conventional Processors

In most conventional processors where the working procedure to generate curved surfaces in circular direction on the workpiece is controlled corresponding to the rpm of the spindle rather than the acceleration exerted on a slider as in the claimed invention, the circular velocity of the workpiece is high in circumferential fringe larger in radius and gets less as the cutting operation proceeds away from the circumferential fringe toward the center of the workpiece. Thus, conventional processors fall short of exhibiting their full ability over their entire working operation, resulting in less use in working velocity.

In comparison, in the claimed invention, the acceleration of the slider is targeted, for example, the top acceleration and correspondingly the rpm of the spindle varies to make the most of the functions

of the processor, helping to much improve the cutting efficiency to generate the curved surfaces on the workpiece.

JP 2002-126907

In comparison to the claimed invention this Japanese reference which is a commonly assigned application discussed in Applicant's specification, is a NC processor which is not controlled to correspond to the acceleration force necessary to reciprocally move the slider as in the claimed invention, but is controlled by the rpm of the spindle which is fixed at a predetermined value. Thus, the JP reference clearly does not suggest or teach the primary function of the claimed invention.

Watanabe '971

- (1) This patent discloses only the machining apparatus for making a scroll part worked along a desired involute curve. The machining apparatus has control means to control the rotation of the spindle, the movement of the first carriage means, and the movement of the second carriage means (see claim 1 of Watanabe).

- (2) Applicant submits that the machining procedure as disclosed in Watanabe is not practical because the real time during working while reading the data requires time to conduct the computing operation beyond that of the claimed invention.
- (3) The peripheral velocity change splitting method has to only perform the machining to get two-axis relation (movement of the X-axis direction and the rotation in the direction C) smaller than a predetermined value (see column 5, lines 36-48 of Watanabe).
- (4) The prediction control of Watanabe is operated in a way funding a transfer function in reference to frequency characteristics of the servo system that have been determined as a result of a series of experiments, and then correcting X, C, T data according to the transfer function so determined (see column 6, lines 15-30 of Watanabe).

Applicant respectfully submits that the cited prior art whether cited alone or in combination fail to teach the claimed invention which patentably defines over the cited prior art.

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Amdt. dated July 6, 2005  
Reply to Office Action of April 7, 2005


Acknowledgement by the PTO of the receipt of applicants' papers filed under Section 119 is noted.

The prior art documents made of record and not relied upon have been noted along with the implication that such documents are deemed by the PTO to be insufficiently pertinent to warrant their applications against any of applicant's claims.

Favorable reconsideration and allowance are earnestly solicited.

Respectfully submitted,

BROWDY AND NEIMARK, P.L.L.C.  
Attorneys for Applicant(s)

By 

Norman J. Latker  
Registration No. 19,963

NJL:ma  
Telephone No.: (202) 628-5197  
Facsimile No.: (202) 737-3528  
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